1917.

NEW ZEALAND.

ORGANIZATION OF SCIENTIFIC AND INDUSTRIAL RESEARCH

(REPORT BY G. HOGBEN, ESQ., C.M.G., AND DR. J. ALLAN THOMSON, ON THE)

Laid on the Table of the House of Representatives by Leave.

SIR,— Wellington, 2nd October, 1917.

In accordance with your request, we have the honour to submit the attached report on schemes adopted in various parts of the British Empire and in the United States for the organization of scientific and industrial research.

We have, &c.,

G. HOGBEN.
J. ALLAN THOMSON.

The Hon. G. W. Russell,
Minister of Internal Affairs, Wellington.

I. GREAT BRITAIN.

BY Order in Council, 28th July, 1915, a COMMITTEE OF THE PRIVY COUNCIL, consisting of six members, the Lord President being the Chairman, was appointed to direct the application of any sums of money provided by Parliament for the organization and development of scientific and industrial research. It was further ordered that, for these purposes, there should be an ADVISORY COUNCIL (which consisted at the outset of eight eminent scientific men, three at least of whom were actually engaged in industries dependent on scientific research). To it stood referred for their report and recommendation proposals—

(i.) For instituting specific researches;
(ii.) For establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades; and
(iii.) For the establishment and award of research studentships and fellowships.

Provision was made for a salary to the Administrative Chairman of the Advisory Council (Sir William S. McCormick), and for remuneration (presumably by fees) to the other members.

At the same time a circular was issued by the President of the Board of Education (Vice-Chairman of the Committee of Council) explaining more fully the objects of the scheme, and establishing the offices of the Committee and the Council at the Board of Education, Whitehall. It was stated that arrangements would be made to keep the Council in close touch with all Government Departments concerned with or interested in scientific research (including the National Physical Laboratory). It was also proposed to ask the Royal Society and similar bodies to undertake the function of initiating proposals for the consideration of the Advisory Council, though the Council itself was to be at liberty to initiate proposals.

A clause in the circular indicated that the scheme was to operate throughout the United Kingdom.

One of the first acts of the Council was to make a register of researches, and of the existing provision for research.

It was contemplated that the Advisory Council would work largely through subcommittees reinforced by suitable experts in the particular branch of science or industry concerned. During the first year of operation three such committees were set up—namely, the STANDING COMMITTEES ON ENGINEERING, METALLURGY, AND MINING respectively. Other questions were dealt with by means of small special committees of the Council itself, and in the first report of the Advisory Council Standing Committees on Fuel, Rubber, Chemistry of Cotton and Paper, and on Textiles (with special sections for cotton, wool, and silk) were contemplated.

The sum voted for the first year was £25,000. The first annual report shows that aid was given to eleven researches already in progress, and to nine new researches. In each case some institution or body was made responsible for the research—*e.g.*, the Sheffield University and the Silk Association. Grants amounting to £6,000 were recommended by the Council to forty individuals.

The Advisory Council was kept in touch with the Government Departments by means of "Assessors," who were appointed by the Departments and had the right to attend meetings of the Council, and to take part in the discussions, but not to vote.

For the second year (1916–17) the sum voted by Parliament was £40,000, but during the course of the financial year the Government decided to establish a department, the DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, to take the functions and powers of the Committee of the Privy Council the official members of which became a trust to administer public and other funds given for the purpose named.

The appropriation for the year accordingly took the following amended form :—

	£
(*a*.) Salaries, wages, and allowances	7,250
(*b*.) Travelling and incidental expenses	800
(*c*.) Grants for investigations carried out by learned and scientific societies, &c.	24,000
(*d*.) Grants to students and other persons engaged in research ..	6,000
(*e*.) Scientific and industrial research (grant in aid)	1,000,000
	£1,038,050

Items (*a*) to (*d*) are ordinary annual votes which lapse at the end of the financial year. Items (*c*) and (*d*) are to be distributed by the Committee of the Privy Council, on the recommendation of the Advisory Council, and are intended to meet cases in which assistance is required by the individual worker or by learned, scientific, or professional societies which stand in need of funds to carry on research work. Item (*e*) is to be paid to the IMPERIAL TRUST FOR THE ENCOURAGEMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, and is intended to cover expenditure for the next five years. The expenditure of the Trust will be audited by the Comptroller and Auditor-Gene al, but any balance remaining on the account will not be surrendered at the close of the financial year. Grants will be made by the directions of the Committee of the Privy Council over an agreed period to approved trade associations for research, to supplement the funds of the associations, and payments in respect of such grants will not be liable to surrender by the grantees at the end of the financial year. It is intended by this method to encourage the formation of trade associations which will survey the conditions in their respective industries and decide upon and initiate desirable researches. Such associa ions should work under carefully selected committees of direction, including some leaders in the industry concerned, men of science, and also representatives of the skilled workers in the different trades.

In order to encourage firms to make generous contributions, money devoted to research, on specified terms, will be regarded as "working-expenses," and will thus be free from income-tax and excess-profit tax. Money so allotted by traders must be devoted to a research or to an association for research under partial State control.

A substantial gift has already been made to the Imperial Trust by two members of the Institution of Mechanical Engineers for the conduct of a research in engineering to be approved by the Department.

IMPERIAL SCHEME.

Consequent upon the publication of the proposals for the original British scheme, suggestions were made by the Minister of Public Works of Victoria, and by the Premier of New South Wales, that the scheme should be extended and made applicable to the overseas dominions, or even to the Empire as a whole. A memorandum drawn up by the British Committee of Council was therefore, on the 2nd March, 1916, circulated to all the Governments of the overseas dominions, concurring in the suggestion, and inviting each Government to constitute some body or agency having functions similar to those of the Advisory Council which acts for the United Kingdom. The memorandum lays stress upon two points: First, any body or agencies instituted for the purpose should, under their respective Governments, have really responsible functions and substantial authority; secondly, a close connection should be maintained between these bodies and the public educational systems and institutions of their respective countries.

II. COMMONWEALTH OF AUSTRALIA.

ADVISORY COUNCIL OF SCIENCE AND INDUSTRY.

The ADVISORY COUNCIL was originally appointed by order of the Governor-General in Council on the 16th March, 1916. Since that date certain additional appointments have been made, so that the Council now consists of thirty-five members representative of both science and industry,

and includes members from all the Australian States. It is a temporary body, designed to prepare the ground for a proposed permanent INSTITUTE OF SCIENCE AND INDUSTRY, and to exercise in a preliminary way the functions that will in future belong to the Institute. The chief of these functions are—

"(i.) To consider and initiate scientific researches in connection with, or for the promotion of, primary or secondary industries in the Commonwealth; and

"(ii.) The collection of scientific industrial information and the formation of a bureau for its dissemination amongst those engaged in industry."

At its first meeting the Advisory Committee elected an EXECUTIVE COMMITTEE, of which the Prime Minister (or, in his absence, the Vice-President of the Executive Council) is Chairman. The Deputy-Chairman is Professor D. Orme Masson. The Executive Committee at first consisted of six members besides the Chairman; to these were afterwards added the Chairman of the several STATE COMMITTEES as members of the Executive Committee *ex officio*. These members serve to keep the Executive and the State Committees in touch with one another. To secure this connection still more closely, additional members (included above) were added to the Advisory Council, so that there should be at least three members of the latter on each State Committee.

The committee in each State consists of the State representatives on the Advisory Council together with any other associate members appointed on the nomination of State Governments, one of whom is generally a professor of the university.

The Advisory Council itself has held only two meetings, most of its work being done by committees. The Executive Committee up to the 30th June, 1917, had held altogether ninety-two meetings.

The first work of the Advisory Council was, *inter alia*,—

(1.) To make a register or census—
- (*a.*) Of Australian industries, their distribution and importance;
- (*b.*) Of problems connected with them;
- (*c.*) Of the equipment and personnel of laboratories available for industrial scientific research;
- (*d.*) Of research work in actual progress in laboratories and at Government experimental farms; and
- (*e.*) Of the facilities available for the proper training of future scientific investigators:

(2.) To establish relations with other authorities, as State Governments, scientific and technical departments, universities, technical colleges, scientific societies, and associations and committees representing the pastoral, agricultural, manufacturing, and other industries:

(3.) To encourage and co-ordinate researches already in progress (much of the work of the executive has been of this kind).

The next step was the initiation of new researches. Having collected all the information from reports and experts on any special question, the executive appointed in each approved case a small SPECIAL COMMITTEE to report further or to carry out actual experimental investigation. In the latter case the executive selected the locality and the institution for conducting the research, appointed a salaried investigator to assist the Special Committee, and voted a reasonable sum for expenses.

Twenty such Special Committees were appointed up to the 30th June, 1917; some of these committees each carried out or initiated several researches. Their work was in addition to the research work being carried out by Government Departments, by such societies as the Pastoralists' Committee, and by universities and other institutions, or by two or more of these bodies acting together. It would be difficult to exaggerate the value of the researches already completed or the importance of those in progress or contemplated: a fairly exhaustive account of them appears in the Report of the Executive Committee dated the 2nd July, 1917.

The scheme distinguishes between laboratories primarily for scientific research and laboratories primarily for the necessary routine work of departmental testing. It is recommended that—

"(*a.*) The control of the present Commonwealth laboratories be not disturbed, but that they be co-ordinated, their staffs increased, and their equipment improved:

"(*b.*) Any new national laboratories which may be created for special purposes of research and experimental inquiry, including a physical laboratory for testing and standardizing purposes, should be controlled by the Institute."

The Executive Committee, in the report already referred to, urgently recommends the establishment of the permanent institute under statutory authority. It advises a constitution substantially in accord with that set forth in the original draft of January, 1916, which in brief was as follows:—

"(i.) That an Advisory Council consisting of nine members representing science and the principal primary and secondary industries should be appointed by the Governor-General in Council.

"(ii.) That, for the purpose of controlling and administering the Institute and of collecting information and determining on the researches to be undertaken and directing their elucidation, three highly qualified salaried Directors, of whom one should be Chairman of the Directors, should be appointed by the Governor-General in Council. The Directors should seek the advice and co-operation of the Advisory Council, and should be *ex officio* members thereof.

"(iii.) That of the three Directors one should be an expert business and financial man with ability in organization; the other two should be chosen mainly on account of scientific attainments and wide experience; their tenure should be fixed by the Act; and that the scientific staff should be appointed by the Governor-General in Council on the recommendation of the Directors." Other provisions deal with the vesting of discoveries and inventions in trustees, power to charge royalties for their use, to pay bonuses to inventors, and to charge fees for special investigations.

It is intended that as far as possible the Advisory Council shall act in co-operation with the Advisory Council of the Imperial Privy Council and with similar bodies in other parts of the Empire.

Finance.—A grant of £5,000 was made by the Federal Government to cover the cost of the scientific work of the Advisory Council and of the incidental expenses. In the fifteen months, April, 1916, to June, 1917, the total expenditure was £3,593.

It is understood that for the carrying-out of the original scheme the Prime Minister stated that the Commonwealth Government was prepared to spend £500,000.

III. CANADA.

The British memorandum on the suggestions for making the British scheme applicable to the whole Empire was in Canada referred to the Minister of Trade and Commerce, and on his recommendation the Governor-General in Council approved, on the 6th June, 1916, of the appointment of a

COMMITTEE OF THE PRIVY COUNCIL, consisting of the Minister of Trade and Commerce, the Minister of the Interior, the Minister of Mines, the Minister of Inland Revenue, and the Minister of Agriculture, which should be charged with and responsible for the expenditure of any moneys provided by Parliament for scientific and industrial research; and also of an

HONORARY ADVISORY COUNCIL, responsible to the Committee of Council, to be composed of nine men representative of the scientific and industrial interests of Canada, who should be charged with the following duties:—

(*a.*) To consult with all responsible bodies and persons carrying on scientific and industrial research work in Canada with a view to bringing about united effort and mutual co-operation in solving the various problems of scientific and industrial research which from time to time present themselves:

(*b.*) To co-ordinate as far as possible the work so carried on so as to avoid overlapping of effort and to direct the various problems requiring solution into the hands of those whose equipment and ability are best adapted thereto:

(*c.*) To select the most practical and pressing problems indicated by industrial necessities and present them when approved by the committee to the research bodies for earliest possible solution:

(*d.*) To report from time to time the progress and results of their work to the Minister of Trade and Commerce as Chairman of the Committee of Council.

It was further resolved that a competent secretary be appointed on the nomination of the committee and paid by the Department of Trade and Commerce, and that the travelling-expenses of the committee should be paid by the Department of Trade and Commerce.

On the 29th November, 1916, the nine members of the Honorary Advisory Council were appointed, six of them being presidents or professors of Canadian universities.

On the 13th December, 1916, the number of the members of the Honorary Advisory Council was raised to eleven, and Dr. A. B. Macallum was appointed permanent chairman of the said Council, with headquarters at Ottawa, with a salary of 10,000 dollars per annum, to date from the 15th December, 1916. This charge and other expenses were to be payable out of the vote for 1916–17 to provide for the development and extension of Canadian trade.

IV. UNITED STATES OF AMERICA.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

In the United States before the war scientific research was probably better organized than in any other country except Germany. The chief agencies were several important Government scientific bureaux; certain institutions privately, and in a few cases munificently, endowed for research; some universities and schools of technology carrying on researches, and scientific societies and industrial corporations giving a certain amount of opportunity for and support of research. What was chiefly wanting was organization and co-ordination, to avoid overlapping and to secure the proper distribution of effort over the whole field in which scientific research in connection with national defence and industrial efficiency was likely to be profitable.

One way in which two universities assisted in the work of scientific industrial research may be specially mentioned—namely, by the establishment of the DUNCAN AND MELLON INDUSTRIAL FELLOWSHIPS in connection with the Universities of Kansas and Pittsburgh respectively. The Mellon Institute of Industrial Research was established in 1910 as an integral part of the University of Pittsburgh. About £100,000 was given by the brothers Mellon for its establishment, of which one-half was used for the permanent building, £12,000 for equipment and apparatus, and £4,000 for the chemical library. Dr. A. K. Duncan, who had in 1907 founded a system of industrial fellowships

at the University of Kansas, was the first Director. The Mellon Institute contains fifty-seven laboratories, a large library, machine-shop, &c., accommodation being thus provided for seventy research workers, and for a number of graduated students studying specific industries. Equipment is provided for large scale operations, special plants being built when the work cannot be carried out with greater efficiency in the factory. Under the scheme a contract is entered into between the manufacturer and the university in which the object of the research is precisely defined. The research is carried out by a qualified investigator selected as Fellow on the recommendation of the Director. The manufacturer pays the funds for the fellowship and for special equipment or apparatus required for the research. The Fellow receives, besides his emoluments, 10 per cent. or more of the net profits arising from the invention, or a capital sum in lieu thereof. In some cases several Fellows are selected to carry out a research; the emoluments vary according to circumstances. Up to the 1st February, 1914, forty-four* researches had been undertaken by seventy-seven Fellows, dealing with a wide range of important matters chiefly connected with chemical manufactures, engineering, and mining. There are fourteen Fellows on the permanent staff. At the University of Kansas during five years eighteen investigations, mostly chemical, were carried out in a similar manner by twenty-two Fellows. It is interesting to note that about 70 per cent. of the problems assigned to the Mellon Institute for study during the five years 1911–16 were solved to the satisfaction of the donors.

National Research Council.

In April, 1916, the National Academy of Sciences offered its services to the President of the United States in the interest of national preparedness. President Wilson accepted the offer, and, after preliminary work by an organizing committee and the appointment of representatives of the Army, Navy, Smithsonian Institute, and various scientific bureaux of the Government and of universities, scientific associations, and of engineering institutes and societies, the National Research Council was formed, and held its first meeting in September, 1916. The Council consisted of thirty-seven members, Dr. George E. Hale, Director of the Mount Wilson Solar Observatory, being Chairman. The main work, however, is done by the Executive Committee, consisting of ten members (now more), of which J. J. Carty, Chief Engineer of the American Telephone and Telegraph Company, is Chairman. This committee meets fortnightly. Committees were also set up to prepare a national census of research and of the equipment and personnel available, and for other purposes of organization.

The research committeess are of two kinds: (*a*) Central committees, dealing with various departments of science, composed of leading authorities in each field; (*b*) local committees in universities, colleges, and other co-operating institutions engaged in scientific research; and other special committees.

It is not intended to supersede or to interfere with existing institutions carrying on research, but where necessary to increase their usefulness by placing additional funds at their disposal and in other ways. For instance, each State is to have an additional grant of £3,000 a year for research conducted by institutions situated in it. The Throop College of Technology, a research institute in California, received a grant of £20,000, and the Massachusetts Institute of Technology a gift of £100,000, to be used for the most part for research.

The relation between the central committees and the local and other special committees may be illustrated by reference to chemical research. There is a central committee of chemistry, which deals in the first instance with all industrial problems connected wholly or mainly with chemistry. This committee defines the specific problems to be investigated, and assigns them to the local committees at certain institutions, or to other special committees consisting of experts in the branch in question.

It must be remembered that in all cases a close connection is maintained between the scientists and the manufacturers and business administrators.

The method of the management of the finance in the United States is not clear. It is evident that the Federal Government provides a considerable sum, by grants and through the several Departments; some of the money is provided by the National Academy of Sciences, and by the institutions that carry out the researches. There appears to have been no difficulty up to the present caused by lack of funds.

V. SOUTH AFRICA.

1. As a consequence of the memorandum from the Committee of the Privy Council the South African Government towards the end of the year 1915 appointed a committee under the title of the Government Munitions and Industries Committee, the members being representative of the Chambers of Commerce and Manufacturers' Associations. The work of this committee was in the main confined to practical engineering matters, and by no means covered the whole field of industrial research.

II. In October, 1916, the Government appointed an Industries Advisory Board, which was intended to have a wider scope; its members, who were to hold office for three years, were almost exclusively business men representative of commerce, manufactures, and labour.

III. In February, 1917, the Advisory Board recommended "the appointment of a Scientific and Technical Advisory Committee to deal with all scientific and technical questions, and questions of research which may be referred to them by the Industrial Advisory Board." The Government accordingly constituted a committee of ten members—scientists and engineers—whose functions were

* This number has been more than doubled in the last two years.

to be—to provide for scientific research; to co-ordinate industrial investigation and research in South Africa; to co-operate with other Government Departments in South Africa and with similar Departments in the United Kingdom and the Dominions; to carry out an economic survey of the resources of South Africa; and to deal with certain other economic, industrial, statistical, and educational matters. Both the Board and the committee are under the control of the Minister of Mines and industries. The committee has begun its work by instituting a general survey of the position in the Union under forty-eight special headings, covering a wide range of natural and manufactured products of South Africa, each portion of the "survey" being entrusted to a reporter, who is apparently a scientific or technical expert.

VI. NEW ZEALAND.

The British memorandum on the suggestions for making the British scheme applicable to the whole Empire was referred by the Hon. Minister of Internal Affairs to Dr. Thomson for report. At that time the original Australian proposals were also available in New Zealand. Dr. Thomson's report consisted of two parts, the first exposing the defects of the pre-war relationship between science and industry, the second outlining proposals for New Zealand. It was pointed out that any scheme for Government organization was likely to fall short of the best results unless the national attitude to scientific investigation could be greatly improved, and the schools and colleges, the Workers' Educational Association, the museums and public libraries, the scientific societies, the cinematograph, and the Press were indicated as the agencies by which this education of the public might be carried out. In particular a popular journal of science and industry was advocated, but this was found to be impracticable owing to the shortage of paper.

The machinery proposed for the organization of research consisted of the Departments of Agriculture and of Mines as at present constituted and a new DEPARTMENT OF SCIENCE AND INDUSTRY, in which several existing Departments were to be merged—viz., the Dominion Laboratory, Observatory and Tidal Survey, Meteorological Office, Magnetic Observatory, Dominion Museum and Scientific Library, Geological Survey, Census and Statistics Office, Patents Office, and possibly also the Board of Trade. The new Department was to have, instead of an Under-Secretary, a salaried Board of three directors, of whom one should be an expert business and financial man with ability in organization, and the other two should be chosen mainly on account of scientific attainments and wide experience. Associated with the Board in advising the Minister as to the policy of the Department there was proposed an ADVISORY COUNCIL representative of science and industry, one of the functions of which was to review annually the scientific work of all Government Departments, as is done in India by the Board of Scientific Advice. Provision for the promotion of scientific and industrial research was to be made in the form of a RESEARCH INSTITUTE on the Australian model, which would have a small permanent staff, but would work mainly by a series of industrial fellowships similar to those in the Mellon Institute of America, and would co-operate with the University colleges.

These proposals were considered by the Government as too ambitious to bring into operation during the war, and a simpler scheme was sought. In the meantime the British White Papers were submitted to the University colleges and to the General Council of Education. At the same time the various branches of the New Zealand Institute took up and discussed the question, and in Otago a separate body, the "Institute of Industrial Science of Otago," was set up to create a better organization of science in its relation to industry. A valuable report was published on the 20th November, 1916, by the Auckland Institute covering the whole question, and as an aid to the organization of national efforts it was recommended that LOCAL ADVISORY BOARDS OF SCIENCE AND INDUSTRY should be formed in the four chief centres, with secretaries in receipt of a Government salary. The establishment of Government laboratories in each of four chief centres was advocated, providing not only for ordinary chemical analysis, but also for agricultural and bacteriological work. Chairs of Agriculture, with associated experimental stations, should be founded in connection with at least one University college in each Island.

At the annual meeting of the New Zealand Institute on the 31st January, 1917, the reports of the affiliated societies were adopted, and the following resolutions were passed:—

(1.) That scientific research be endowed to a very much greater extent than has been done in the past.

(2.) That the importance of research in pure science be recognized as of equal importance with that in applied science.

(3.) That as a definite step towards the endowment of research adequate provision be made for the appointment of fully qualified assistants to the Professors of Science in the four University colleges.

(4.) That a BOARD OF SCIENCE AND INDUSTRY be constituted, to consist of—(*a*) Members selected by the New Zealand Institute; (*b*) representatives of the scientific Departments of the Government; and (*c*) leaders in industry and commerce. This Board to recommend and direct research problems, and to have power to spend money voted by Parliament for the purpose.

The New Zealand Institute further offered its services at a deputation to the Acting Prime Minister, and received the reply that the matter would be referred to the National Efficiency Board, the setting-up of which was contemplated.

The subject was also considered on the 1st February, 1917, by the Board of Science and Art, and the following resolutions were adopted :—

(1.) That in accordance with section 9 (2) of the Science and Art Act, 1913, this Board advises the Government to constitute a CENTRAL ADVISORY BOARD FOR THE CO-ORDINATION OF SCIENCE AND INDUSTRY. The Board so constituted should include representatives of the business, industrial, and agricultural sections of the community and of scientific men and educational experts. That further LOCAL ADVISORY COMMITTEES of similar constitution be formed in the chief centres.

(2.) That with a view of giving effect to the above the Government be requested to call a representative conference.

(3.) That a committee be appointed to draw up concrete proposals to submit to this Board at a future meeting, such committee to consist of Dr. J. A. Thomson, Messrs. Morgan, von Haast, and Ewen, with power to add to their number.

Under clause 21 of the reference to the National Efficiency Board, gazetted on the 15th March, 1917, it became its duty "to inquire as to the advisability of adopting improved methods for the instruction and technical training of workers with a view to securing more efficient service, and generally as to the necessity for further technical education, and for scientific research with respect to the maintenance, development, or establishment of industries"; and under clause 22, "to inquire as to the advisability of establishing new industries in New Zealand, or of developing existing industries, whether during or after the war."

The Efficiency Board resolved that the Standing Committee of the New Zealand Institute be asked to advise the Chairman on the matter, with power to consult other scientific men and technologists in the Dominion. It was desired that a scheme should be so arranged as to provide a maximum of efficiency with the minimum of overlapping or duplication of scientific work, and that any such scheme should be of such a character as would probably ensure its acceptance by the Government or by Parliament. It should be of such a nature (in the opinion of the Chairman of the Board) as would embrace, assist, or absorb the best work and workers of the existing scientific institutions of the Dominion, and homologate the scientific work of various Government Departments at present scattered under departmental controls.

The Standing Committee of the New Zealand Institute has therefore set up an Industrial and Research Committee in Wellington to receive and co-ordinate suggestions from the affiliated societies of the Institute and from other bodies interested, and to frame a scheme for submission to the Board of Governors. Consequent on the resignation of the National Efficiency Board, the Chairman of that Board has intimated that it is the desire of the Government that the New Zealand Institute should proceed with its deliberations and report directly to the Government.*

In the meantime the General Council of Education had set up a Recess Committee to consider the adaptation of the educational system of the Dominion to the development of its resources. The committee met in Christchurch from the 16th to the 18th May, and the report dealing with scientific research was adopted by the Council in the following form :—

1. There should be a NATIONAL ADVISORY COUNCIL ON RESEARCH, consisting of—(*a*) Four scientific men, one of whom should be a scientific expert attached to a Government Department (*b*) three members connected with leading industries of the Dominion, one of whom should represent agriculture.

2. The National Advisory Council should—

(i.) Consider and allot to the proper persons for investigation all proposals for specific researches (or at its discretion reject such proposals). The proposals might be referred to it by the Efficiency Board, or might come from institutions or societies or private persons, or might originate in the Council itself.

(ii.) The Council might also consider the problems affecting particular industries, to determine along what lines research might be instituted.

(iii.) The Council should award and supervise the tenure of the Research Fellowships mentioned below, and should, on the request of the University of New Zealand, consult with and advise the Senate of the University in matters relating to the National Research Scholarships in the award of that body.

(iv.) The Advisory Council should consider and advise the General Council of Education as to the lines along which there could be brought about a general improvement in scientific education with a view to the training of experts, and should co-operate with that Council and other public bodies in taking such steps as may lead to the better appreciation of the aims and advantages of science on the part of producers and the general body of citizens.

3. In addition to the existing National Research Scholarships (the number of which should be increased) there should be established Research Fellowships tenable for two, three, or more years by men or women qualified and willing to conduct researches approved by the Council. (The fellowships should be of sufficient value to prevent the possible holders from being attracted away to other positions.)

* In view of the reappointment of the National Efficiency Board, the Institute will presumably report to that body as originally requested.

4. The University and the University colleges should assist the Fellows in their research in such ways as may be arranged.

5. It is suggested that three Ministers of the Crown should form a RESEARCH COMMITTEE OF THE EXECUTIVE COUNCIL, and that all the proposals of the National Advisory Council involving additional expenditure or a question of policy should come before the committee for approval. Except in this respect the National Advisory Council should not be considered as a department of the Public Service, but should be free to act as it thought fit in regard to matters within its control; for instance, the Research Committee might approve of the creation of an additional fellowship, but the Council alone should award it and decide the line of research, or at least define the problem to be solved, which might require to be modified as the research proceeds.

6. (i.) In further explanation of the functions of the National Advisory Council it is suggested that the following should be included among them: The Council might—

(*a.*) Recommend to industrial firms or companies scientific managers, superintendents, assistants, or scientific experts:
(*b.*) Advise industrial firms or companies as to improvements in the arts and processes employed, and as to the utilization of waste products:
(*c.*) Make recommendations as to the adoption in any industry of the results of investigations conducted under its directions:
(*d.*) Undertake the investigation of industrial problems that, if unsolved, would obstruct the development of industries concerned:
(*e.*) Advise the Government in regard to the help that should be given to any new industry that is likely to be ultimately of value to the country, though at first it may not be worked except at a loss.

(ii.) The Council might advise the Government as to what contribution, if any, should be made towards the cost of any research by the firms or companies concerned.

7. That all bulletins and reports relating to the researches set up by the Council should be drawn up and published with its authority.

8. That the Council of Education communicate with the Chambers of Commerce, the annual conferences of the Agricultural and Pastoral Association, the New Zealand National Dairy Association, and the New Zealand Farmers' Union intimating that the Council would welcome any suggestion from these bodies as to how the educational agencies of the Dominion might assist in achieving the purpose of bringing the produce of our New Zealand industries into the most profitable relationship with the markets of the world.

9. That the attention of the Government be called to the necessity of establishing a course for the training of hydro-electric engineers.

The Science and Industry Committee of the Wellington Philosophical Society has also been deliberating during the past few months, and on their initiative the Society has adopted the following scheme:—

1. (*a.*) There should be established a BOARD OF SCIENCE AND INDUSTRY, with responsible functions and substantial authority, to encourage and co-ordinate scientific and industrial research in the Dominion.

(*b.*) There should be a MINISTER OF SCIENCE AND INDUSTRY, who should be the Chairman of the Board.

(*c.*) The Board should consist of the Minister and three salaried Directors, two of the latter being chosen for their scientific knowledge, and one for wide business and administrative experience: one member to be Deputy-Chairman.

(*d.*) The Board of Science and Industry should be a Trust to administer public and other funds given for the purpose for which it is constituted.

(*e.*) An adequate sum—say, £100,000—should be voted by Parliament to cover the expenditure for five years, one-fifth to be paid to the Trust in each year.

(*f.*) The expert and clerical staff of the Board should be appointed by the Board. (The clerical staff should have some acquaintance with science or with its application to industry.)

2. (*a.*) To assist the Board of Directors there should be a NATIONAL ADVISORY COUNCIL ON RESEARCH, consisting of—(i) Four scientific men, two of whom should be appointed by the Governor-General in Council, one by the University of New Zealand, and one by the New Zealand Institute: (ii) five members connected with industries of the Dominion, one of whom should represent agriculture; such members to be appointed by the Governor-General in Council: (iii) one member elected by each Local Advisory Committee: (iv) the three Directors of the Board, *ex officio*.

(*b.*) Each of the Government Departments concerned in scientific work should have the right to appoint one of its officers to act as Assessor on the National Advisory Council. Assessors should receive the agenda papers and minutes of the Council, and have the right to attend any meeting on behalf of their Departments and to take part in its discussions, though not to vote.

3. There should be four or more LOCAL ADVISORY COMMITTEES, constituted in such manner as may be prescribed by the National Advisory Council, each consisting of not less than five or more than nine persons representative of science and industry. The members of the National Advisory Council who at the time are resident in the district should be *ex officio* members of such Local Advisory Committee.

The Committees should inquire into problems connected with the industries in their respective districts that seem likely to benefit from research, supervise such researches as are referred to them by the Board, and in general assist the Board and the National Advisory Council in their work.

4. The Board, with the assistance of the National Advisory Council and the Local Advisory Committees, should make a review—

(*a.*) Of all research work that has been done or is in progress in connection with science and industry in the Dominion :

(*b.*) Of problems to be solved in connection with existing industries or with industries to be established.

5. The Board after consultation with the National Advisory Council should consider all proposals for specific scientific researches, and allot to the proper person or persons the duty of conducting such specific researches as they may approve. The Board should also deal with problems affecting particular industries in order to determine along what lines research might be instituted.

6. The Board should have power to establish, award, and supervise Research Fellowships tenable for two, three, or more years (according to the time required for the research in question) by men or women qualified and willing to conduct researches approved by the Council. (The fellowships should be of sufficient value to prevent the holders from being attracted to other positions.) The Board should also have power to make grants of money in aid of research, in payment for services, or for apparatus, material, rent, and other incidental expenses.

7. The Board should obtain, as far as possible, the assistance of Public Departments, the University of New Zealand, the University Colleges, and other institutions, and of societies and private persons, in carrying out the researches.

8. The National Advisory Council should, on the request of the University of New Zealand, consult with and advise the Senate of the University in matters relating to the National Research Scholarships in the award of that body. It is desirable that the number and value of these scholarships should be increased in order to train a sufficient number of persons in the methods of research.

9. The Advisory Council should consult with and advise the General Council of Education as to the lines along which there could be brought about a general improvement in scientific education with a view to the training of experts, and should co-operate with that Council and other public bodies in taking such steps as may lead to the better appreciation of the aims and advantages of science on the part of producers and the general body of citizens.

10. The duties of the Board of Science and Art in respect to scientific publications should be transferred to the Board of Science and Industry, which in this regard should act on the advice of the National Advisory Council. All bulletins and reports relating to the researches set up by the Board should be drawn up and published with its authority.

11. In further explanation of the functions of the Board of Science and Industry it is suggested that the following should be included among them. The Board might—

(*a.*) Advise industrial firms or companies as to improvements in the arts and processes employed and as to the utilization of waste products :

(*b.*) Make recommendations as to the adoption in an industry of the results of investigations conducted under its directions :

(*c.*) Undertake the investigation of industrial problems that, if unsolved, would obstruct the development of the industries concerned :

(*d.*) Advise the Government in regard to the help that should be given to any new industry that is likely to be ultimately of value to the country, though at first it may not be workable except at a loss :

(*e.*) Advise the Government as to what contribution, if any, should be made towards the cost of any research by the firms or companies benefited thereby.

During the past year various industrial bodies have discussed the general question, and have passed resolutions approving of increased Government aid to industrial research, but no details of any scheme have been framed by them.

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